# Homework 3 Functional programming Answers

1. (a) What is a programming paradigm? [1]

A style of programming

(b) Name **four** programming paradigms and for each one, give an example of a programming language which supports it. [8]

(i) Procedural – Python, VB, Delphi, C, other examples

(ii) Object oriented – Java, Python, VB, Delphi, C++

(iii) Declarative – SQL, Prolog

(iv) Functional – Haskell, Standard ML, Scheme, Lisp

2. (a) Use functional programming notation to define a function named trebleMinusFive, defined below.

f(x) = 3x – 5 [2]

trebleMinusFive x = 3\*x – 5

(b) Write a function definition for a second function named doubleIt which   
returns the value of g(x) = 2x. [2]

doubleIt x = 2\*x

(c) Combine the two functions in **(a)** and **(b)** to write a function h(x) which returns   
the value of

h(x) = g(f(x))

Name the function trebleThenDouble.

What will be returned when this function is applied to the parameter 4? [2]

trebleThenDouble x = doubleIt (trebleMinusFive x)

trebleThenDouble 4 returns 14

3. In a functional programming language, variables are **immutable.**

Explain, with an example, what this means and compare the way variables can be used in the functional and procedural paradigms. [3]

Immutable means that the value cannot be changed (1). In a procedural language it is possible to assign a new value at any point in a program (1). For example,

x = x+1

cannot be implemented in a functional language but can in a procedural one (1)

4. Functional programming is **stateless** and has no **side effects**. Explain the meaning of these two terms. [3]

Stateless programming does not change the state of memory, for example the values of variables. (1) Therefore there is no record of previous operations/each operation is processed using only the arguments/parameters provided (1)

will always return the same result for a given input (1) cannot affect other operations within the program (1) *Max 3*

5. (a) List **two** properties of a first-class object. [2]

may appear in expressions, be assigned to a variable, be assigned as   
arguments, be returned in function calls.

(b) Give **two** examples of first class objects. [2]

integers, floating point values, characters, strings, functions

[Total 25 Marks]